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Evaluation of the Veterans Administration rehabilitation program for students entering Iowa State College

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NOTE TO USERS

EVALUATION OF THE VETERANS ADMINISTRATION REHABILITATION PROGRAM FOR STUDENTS ENTERING IOWA STATE COLLEGE

134

by

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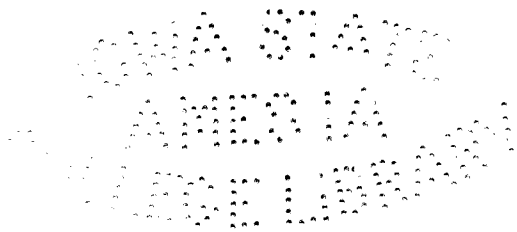

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I. INTRODUCTION

Since the end of the school year 1946-1947, the number of veterans from World War II has been on the decline. At the end of January 1947, the Veterans Administration was providing education and training to approximately 2,400,000 veterans[1]. Of this total, 1,100,000 were enrolled in institutions of higher education. The expenditure to and for veterans enrolled in collegiate training for the school year 1946-1947 totaled $401,670,000 and was at a high figure for a number of years. This total does not include the cost of administration of the program.

With the number of persons involved in such training and the high financial burden of this program it is necessary to consider the importance of the studies and reports on the scholastic achievement and attitude of veterans entering collegiate training. The results of all such studies provide counselors and school administrators with information for future planning both for prospective students and for college officials in the planning for staff and facilities when faced with a sudden influx of students. Of particular value is the information which the specialist in counseling may employ when counseling students whose education has been interrupted over a period of years or for students who prefer to attempt to progress through college on an accelerated basis, or those students who seek advice to overcome some physical handicap.

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[1]Hollis, Ernest V. Federal Assistance to Colleges for Veterans. College and University. 23: 50-58. October 1947.

Although many reports are available relative to studies on scholastic achievement of veteran and nonveteran students attending colleges and universities, further investigation of veterans pursuing collegiate academic careers under provisions of vocational rehabilitation would seem warranted. Information concerning the scholastic progress of disabled students attending colleges or universities under Public Law 16 has been limited. Many studies have been reported contrasting the scholastic achievement of the veteran and nonveteran college student. In these studies, almost without exception, no attempt has been made to distinguish between veterans attending under the provisions of Public Law 16 and of Public Law 346.

This study is limited to information concerning students at Iowa State College. Probably typical of colleges and universities of its size, more than 7,000 veterans entered during the school year 1946-1947; 5,100 veterans enrolled in the Fall Quarter of 1948; and 1,991 veterans in the Fall Quarter of 1950.

Classification of students, for purposes of this study, was made into three groups, namely, those enrolling under provisions of Public Law 16, under provisions of Public Law 346, and without assistance from the Veterans Administration assumed to be nonveteran students. A student enrolled under Public Law 16, often has been referred to as a "rehab" student, whereas a student enrolled under provisions of Public Law 346 has acquired the sobriquet of "GI" student. For convenience, in this study, a student is classified as a PL-16 student, a PL-346 student or a nonveteran student.

Scholastic achievement has been chosen as the standard by which the three groups of students may be contrasted. Two criteria were available from the college records by which scholastic achievement could be evaluated. One criterion is the grade point average obtained from the course marks which a student has received. A second criterion is the survival-attrition tendency exhibited by a student (1) graduating from Iowa State College, (2) transferring to another college or university, (3) withdrawing from Iowa State College and not transfering to another institution.

Evaluation of achievement using each of the foregoing criteria constituted the problem for this study. In this evaluation an attempt was made to test the difference between any two groups of students after making allowances for any differences existing between groups in student aptitude. For such control, high school grade point averages and scores available from tests administered during freshman week were available and were employed in this study.

II. REVIEW OF LITERATURE

Although numerous studies have been made by a comparison of academic achievement of veterans and nonveterans, few have made any distinction as to veteran status as distinguished by disability. Osborne, Greene and Sanders[1] reported on 396 nondisabled veterans and 339 disabled veterans at the University of Georgia and found neither group, with respect to scholastic aptitude tests, superior or inferior to the other as shown in Table 1. With respect to academic achievement when scholastic aptitude was

Table 1. Findings of Osborne, Greene and Sanders

Test	Non-disabled veteran	Disabled Veteran	Difference	Criterion Ratio	Changes in 100
ACE					
Q-Score	56.48	55.62	.86	.16	56
L-Score	55.55	47.71	7.84	1.49	93
Total Score	55.55	57.65	-2.10	.41	65
Iowa Content					
English Test	44.81	47.36	-2.35	.66	74

[1]Osborne, R. T., Greene, J. E., Sanders, Wilma B. Are Disabled Veterans Significantly Different from Nondisabled Veterans in Occupational Preferences, Employment Histories, Aptitudes, and College Achievements? School and Society. 72: 8-11. July 1, 1950.

controlled, it was reported that there was a slight but not significant tendency for disabled veterans to earn higher marks than nondisabled veterans in the Division of Agriculture, Business Administration, Arts and Sciences, and Journalism.

The most inclusive study reviewed was that financed by the Carnegie Corporation of New York and reported by Fredericksen and Schrader[1]. The study included 10,000 veteran and nonveteran students in sixteen American colleges. Some of the issues of this study included:

1. Whether veterans did earn better grades in college, relative to ability, than did nonveterans.

2. Comparison of veterans and nonveterans with regard to background and attitudes, as reported by a questionnaire.

3. The value of the questionnaire in identifying promising students.

4. Summary of veterans brought into colleges by the GI Bill.

5. Evaluation of questionnaire information in attempt to account for differences in academic performance between veterans and nonveterans.

6. Comparison of men and women students with respect to academic success, background and attitudes.

Fredericksen and Schrader reported that in general veterans did achieve higher marks relative to ability than did nonveterans, although this advantage was slight. It also appeared that veterans who had

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[1]Fredericksen, Norman and Schrader, W. B. Adjustment to College, Educational Testing Service, Princeton, N. J. 1951.

interrupted their education for war service had a slight advantage over nonveterans. Deignan[1], and Thompson and Pressey[2] in their studies of interrupted college education by veterans stated they could possibly have been a select group and were more highly motivated and more serious than the veterans who failed to resume their interrupted college careers. Thompson and Pressey also reported that those veterans who entered as freshman at Ohio State University after military service and had no previous college educational experience had better academic records and fewer dropped out of school than nonveteran students. The median age for this group of veteran students was 22.2 and for nonveterans 18.5.

Thompson and Flesher[3] reported a study of the academic records for Winter Quarter 1946, of 2020 veterans and nearly 6000 civilian undergraduates in the colleges of Agriculture, Arts, Commerce and Education of the Ohio State University. They found the median point hour ratio of veterans to be 0.17 or about 1/8 of a letter grade higher than the civilian undergraduate.

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[1]Deignan, Francis James. The Effect of Motivational Factors Upon Grades Earned at Clark College by Veterans of World War II. Unpublished A.M. Thesis. Worcester, Mass., Clark University Library. 1947.

[2]Thompson, Ronald B. and Pressey, Sidney L. Analysis of the Academic Records of 2144 Veterans. College and University. 23: 242-252. January 1948.

[3]Thompson, Ronald B. and Flesher, Marie A. Comparative Academic Records of Veteran and Civilian Students. Journal of the American Association of Collegiate Registrars. 22: 176-179. January 1947.

Taylor[1] in his study of comparative grade achievement of veterans and nonveterans in freshman English at the University of Southern California during the period from November 1945 to June 1946 reported that the veterans received a greater proportion of the higher grades and a lower percentage of lower grades than did the nonveterans.

Kvaraceus and Baker[2] reported on the achievement of veterans and nonveterans stating that the veteran student was doing work equivalent to and perhaps better than his nonveteran classmate.

At the University of California, Atkinson[3] studied approximately 1500 veterans and 1500 nonveterans. The findings revealed that veteran performance was appreciably higher in all groups compared and that there was no evidence that the academic proficiency of veterans becomes higher after the first semester of residence.

In a study by Epler[4] it was found that of 164 students, 64 nonveterans, after three quarters of college work, averaged 2.47 and 100

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[1]Taylor, Edgar A. J. How Well Are Veterans Doing? School and Society. 65: 210-213. March 22, 1947.

[2]Kvaraceus, Wm. C., and Baker, James. Achievement of Veterans and Nonveterans in One Required Course at Boston University. School and Society. 64: 384-385. November 30, 1946.

[3]Atkinson, Byron H. Veteran vs. Nonveteran Performance at UCLA. Journal of Educational Research. 43: 299-302. 1949.

[4]Epler, Stephen E. Do Veterans Make Better Grades Than Nonveterans. School and Society. 66: 270. October 4, 1947.

veteran students averaged 2.58. In a similar study at Oklahoma A and M, Orr[1] reported that for the period 1945 to the first semester, male veterans averaged 2.53 while the male nonveteran group averaged 2.42.

At Hobart College, Fine[2] stated a higher percentage of the veterans made the Dean's honor list than civilian students. Also that fewer veterans withdrew at the end of the term and only one-fifth as many were dropped for scholastic reasons. The report by Fine also stated that at Yale the veterans received marks superior to the civilian undergraduates. At Columbia the veterans were found to surpass their nonveteran classmates. In the same report, at Rollins College, Florida, the veterans were found to rank scholastically, considerably above the average.

A study for the purpose of determining the comparative academic achievement during the initial year of college of matched groups of veterans and nonveterans was made by Garmezy and Crose[3]. The investigation included 245 nonveteran and 564 veteran students in the freshman class of September 1946 who entered the College of Liberal Arts at the State University of Iowa. Random selection was made of veteran group and matched with nonveterans according to composite percentile rank on

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[1]Orr, M. G. Grade Point Average of Veterans at Oklahoma A and M College. School and Society. 66: 94. August 2, 1947.

[2]Fine, Benjamin. Veterans Raise College Standards. Educational Outlook. 22: 54-61. 1947.

[3]Garmezy, Norman and Crose, Jean M. Comparison of the Academic Achievement of Matched Groups of Veteran and Nonveteran Freshmen at the State University of Iowa. Journal of Educational Research. 41: 547-550. 1948.

the tests of General Educational Development, which included Correctness and Effectiveness of Expression, Mathematics, Vocabulary and Interpretation of Reading Materials in Social Science. The groups were also equated on the basis of sex, marital status and race. Based on the grade point average over two semesters the veteran group averaged 0.10 of a grade point higher than nonveterans. This was not significant at the 5% level.

At the University of Indiana, Shaffer[1] investigated the credit point ratios for male veteran and nonveteran students with the year held constant. Nonveterans of the same age were found to exceed veterans of the same age in each case. It was stated that the veteran group average was higher because of the higher age, implying that older students make better grades than younger students as a group. In a study at Winona State Teachers College by Owens and Owens, Jr.[2] age and length of military service were included as variables with scholastic aptitude in predicting college achievement. One hundred ninety-four male veterans were included in the study. The mean age for this group was 23 years 3 months. It was found that age was nearly as good a predictor for scholastic success of this given veteran population as was the college aptitude test score. The relationship between length of service and grade point average was low

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[1]Shaffer, Robert H. A Note on the Alleged Superiority of Veterans. School and Society. 67: 205. March 13, 1948.

[2]Owens, Wm. A. and Owens, Wm. A. Jr. Some Factors in the Academic Superiority of Veteran Students. Journal of Educational Psychology. 40: 499-502. 1949.

but negative. The correlation between aptitude test score and grade point average was increased from 0.47 to 0.57 by including estimates of the contributions of length of service and age to this relationship. The American Council on Educational Psychological Examination raw scores were converted into modified standard scores. The prediction formula employed was:

$$Y_4 = 0.0786X_1 - 0.0100X_2 + 0.6813X_3 - 0.6371$$

$$R_{4.123} = 0.57$$

with

X_1 = Age

X_2 = Length of Service

X_3 = Aptitude Test Score (A.C.E.)

A study of the value of the American Council on Educational Psychological Examination in predicting college achievement was made by Thomann[1] at the University of Illinois. He found the correlation between the linguistic, quantitative and total scores of the A.C.E. Psychological Examination and college freshman grade point averages for 278 male students were 0.40 with S.E. of .05, 0.37 with S.E. of .05 and 0.45, S.E. .05 respectively.

Studies dealing with the prediction of attrition-survival tendency are not so abundant and the review of literature includes only those

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[1]Thomann, Don F. Relationships Between the High School and College Editions of the American Council of Education Psychological Examination and Their Relative Value in Predicting College Achievement. College and University. 23: 217-233. January 1948.

studies which are especially pertinent to this investigation. A study at the University of Minnesota was made by Landskov[1]. This survival study included 296 students enrolled as freshmen at the University of Minnesota in the fall quarters of 1935, 1936 and 1937. These three years were considered by the author of the study as normal years since they were relatively unaffected by the approaching national crisis. Of the 296 students investigated, 51.7% dropped, 16.6% transferred and 31.8% graduated.

The problem of survival-attrition of freshmen engineering students who entered Iowa State College was investigated by Dean[2]. Dean reported that of a group of 883 students, 667 of which were veterans and 216 nonveterans, 60% survived to the fourth quarter, 30% graduated and 15% graduated in the upper half of the class. The chances for survival to the fourth quarter, graduating and chances of graduating in the upper half of the class favored the veterans. The difference in each case was not significant. By use of discriminant functions developed the probability tables to predict chances in 100 of survival in engineering in the three aforementioned groups. The information available at the onset of the student's college entrance and employed by Dean as prediction variables was the quantitative and linquistic scores from the American

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[1]Landskov, Norvin L. Suggested Student Survival Techniques Tried Out at the University of Minnesota. College and University. 23: 234-241. January 1948.

[2]Dean, C. Thomas. Prediction of Achievement of Native Students in Engineering at Iowa State College. Unpublished Ph.D. Thesis. Ames, Iowa, Iowa State College Library. 1951.

Council on Education Psychological Examination, the speed and comprehension scores from the Iowa State College Silent Reading Test, the score on the United States Armed Forces Institute Test on Correlations and Effectiveness of Expression, the score on the college level English Placement Test, the score on the Iowa State College Mathematics test and the high school grade point average. The prediction variables from first year college engineering were: grade point average at the end of the first quarter, first quarter achievement in freshmen engineering courses through the first year. From the quantitative score on the American Council on Education and from high school grade point average, a probability table indicated a range from 30 chances in 100 to 82 chances in 100 of beginning the fourth quarter in engineering from prematriculation data. Prediction of fourth quarter attrition-survival tendency was obtained by using first quarter college grade point average. No significant loss in prediction efficiency incurred in dropping the two prematriculation variables.

Again, using the quantitative score on the American Council on Education Psychological Examination and high school average, probability in graduation in engineering was predicted. Tables developed indicated probabilities of survival ranging from 9 chances in 100 to 57 chances in 100. Achievement in the chemistry and mathematics courses of first year engineering proved to be superior in prediction variables without significant loss due to the two prematriculation variables and the first-quarter college point average. Based on first-year chemistry and mathematics, the probabilities of graduation ranged from 20 in 100 to 82 chances in 100.

The third prediction technique was that of tendency to graduate in the upper half of the graduating class. Three methods were derived for this purpose. The first method, based on the quantitative and linguistic scores of the American Council on Education Psychological Examination, yielded probabilities ranging from 3 chances in 100 to 35 chances in 100. A second method, employing the first quarter grade point average, gave probabilities of 6 chances in 100 to 30 chances in 100. The third method yielded chances in 100 to 62 chances in 100 when chemistry and first-year mathematics achievement were used.

McClanahan and Morgan[1] investigated a group of entering engineering freshmen at Colorado Agricultural and Mechanical College in an attempt to evaluate the predictive value of the various tests administered to incoming freshmen students. The scores which were available were the American Council on Education Psychological Examination Chemistry Aptitude Test, the Nelson-Denny Reading Test and the high school rank. A multiple coefficient of correlation of 0.85 was found between the first-year grade point average of freshman engineering students and a battery of scores from the aforementioned tests. It was found that the best single predictor of first-year engineering grades was the chemistry test, followed by the American Council on Education Psychological Examination. Intercorrelations revealed that the American Council on Education Psychological Examination, the Reading

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[1]McClanahan, W. R. and Morgan, D. H. Use of Standard Tests in Counseling Engineering Students in College. Journal of Educational Psychology. 39: 491-501. December 1948.

test and the English test measured much the same thing, and that the English was the best to employ with the Chemistry test.

It was mention of veterans academic success by Gowan[1] that prompted this study. Gowan found veterans at Iowa State College excelled nonveterans in grade average for each of the three quarters of the academic year 1945-46. This difference was significant beyond the one percent level. It is apparent that the number of studies and reports on World War II veterans achievement in college is inexhaustible. However, in reviewing the literature available, the number of studies which have been statistically analyzed is limited.

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[1]Gowan, A. M. Unique Characteristics of Freshman Veterans at the Iowa State College with Administrative Implications. Unpublished Ph.D. Thesis. Ames, Iowa, Iowa State College Library. 1947.

III. METHOD OF PROCEDURE

The purpose of this investigation was to predict the academic achievement and survival-attrition tendency of those students entering Iowa State College as nonveterans and of those entering under provisions of Public Law 16 and 346. For purpose of academic achievement this study used the cumulative grade point average at the time of graduation, dropping out of college or transferring to another college or university. The cumulative grade point average was used as one criterion of achievement since there may be a great variation from instructor to instructor in evaluation of student's achievement. It was felt, however, that the grade point average computed on the basis of total credits and marks accumulated at the time of his graduating, dropping out of school or transferring from Iowa State College would not be objectionable. Prediction of academic achievement indicated by grade point average and survival-attrition tendency was made on basis of test scores compiled by the psychological testing program and records maintained in the registrar's office, these variables being available at the onset of the student's academic career at Iowa State College.

This investigation included a sample of 1050 male students who had had no previous college experience. These students were graduated from secondary schools from within the United States and entered Iowa State College as freshmen in winter quarter 1943 and were included in three aforementioned categories of graduated, transferred or dropped on or before the summer session of 1953. Students under PL-16, PL-346 and

nonveterans currently pursuing their college education were not included in this study.

The group selected to be studied was delimited to those disabled veterans, who had had no previous college experience prior to induction into the armed forces during World War II and had not entered an educational institution other than Iowa State College after advisement from the Veterans Administration. Of the 769 veterans classified as PL-16's only 350 satisfied the criteria. Since approximately 12,500 veterans had entered institutional education at Iowa State College, the cases selected for the PL-346 sample was made by going through registrar's files on veterans and recording every tenth case. This resulted in a sample of 1156 Public Law 346 veterans cases to be studied. Of the 1156 cases, 522 veterans entered Iowa State College after World War II without previous college experience. By the technique of random numbers the number of cases were selected to be used in the investigation. A total of 1287 male nonveteran undergraduate student records were compiled from the registrar's office and 809 of this total satisfied the criteria as mentioned. Again random number technique was employed to select the 350 students for the third group.

The scholastic achievement of veterans under both laws pertaining to veterans was compared, and each of the veteran groups was compared to the nonveteran students. Four variables were used in this study and were collected for each student.

1. The linguistic score on the American Council on Education Psychological Examination, hereafter referred to as the L-score.

2. The quantitative score on the American Council on Education Psychological Examination, hereafter referred to as the Q-score.

3. The high school grade point average.

4. The score on the English Placement Test, hereafter referred to as English placement scores.

For the purpose of converting the letter marking system used at the Iowa State College to grade point averages the letter marks of A, B, C, D and F were assigned the numerical values of 4, 3, 2, 1 and 0, respectively.

The L-score, the Q-score and the English placement scores were reported as percentile ranks. Iowa State College freshman percentile norms served as the basis for comparison of the groups on the American Council on Education Psychological Examination.

Statistical measures used in the treatment of the data were chi square, analysis of covariance, triserial correlation, multiple regression, and discriminant analysis. The mean grade point averages for the three groups, disabled veterans in training under Public Law 16, the veteran in training under Public Law 346 and the nonveteran students, were evaluated without consideration of differences which might be related to scholastic aptitude. Chi square was employed to test the significance of the intercorrelations of the four control variables. Evaluation of the three groups was made using the scholastic aptitude controls. Test of significance resulting from analysis of covariance was made by computing two regression equations, one for predicting the

grade point average when PL-16 and nonveteran students were considered to be a single group and another, when the average regression was determined for the two groups. Similar analysis was made in comparing the PL-16 and PL-346 students, and in comparing PL-346 and nonveteran students.

Based on high school average and English placement score, a grade point average prediction table was developed. The triserial correlation was obtained to find the relationship of grade point average and survival-attrition tendency for the three groups as to graduate, transfer or to drop out of school. Discriminant equations were developed using the high school average and English placement test score. Since discriminant equations as such do not furnish the counselor with a ready instrument for guidance, a probability table was constructed. Such a table, when given the high school average and English placement test score, would indicate the student's chances in 100 of graduating, transferring or dropping out of school based on student's classification as nonveteran or veteran in school under provision of PL-16 or PL-346.

IV. CHARACTERISTICS OF ENTERING STUDENTS

Since the return of World War II veterans to civilian life, approximately 12,500 veterans entered Iowa State College under the provisions of either Public Law 16 or Public Law 346. Of the total veterans in training at Iowa State College, 769 were inducted into training under Public Law 16. It was this group that was selected to determine whether the academic achievement of the disabled veteran was different from his fellow GI classmate attending Iowa State College under provisions of Public Law 346, and students classified as nonveteran.

At the close of World War I, Public Law 178[1], Sixty-fifth Congress, June 1918, was known as the Vocational Rehabilitation Act and provided for the vocational rehabilitation and return to civil employment of disabled persons discharged from the military service. Since this law was repealed in June 1924, it was necessary to enact a similar provision for personnel discharged from World War II military service. Public Law 16, Seventy-eighth Congress, March 28, 1943, was passed to provide this right to World War II veterans. Individuals eligible for education under Public Law 16 must have suffered a service-incurred or aggravated disability during World War II military service. Unlike the veterans in training under Public Law 346, the veteran must receive vocational

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[1]U.S. Congress. House. Federal Laws Pertaining To Veterans, 1914-1950. 82nd Congress, 1st Session. House Document 78. pp. 901-904. Washington, D. C., U. S. Government Printing Office. 1951.

guidance and the approval by the Veterans Administration authorities before induction into training. The choice of objective is limited by the veteran disability and is also influenced by the fact that the rehabilitation program under which they study is primarily training for an employable vocation. After induction into training the students' progress and adjustment is under supervision of the Veterans Administration. For first entry into training for an employment objective, PL-346 veterans were exempted from this regulation.

In checking the files in the Registrar's office and the Veterans Administration, Des Moines, Iowa it was found that a total of 767 male and 2 female veterans had been enrolled at Iowa State College under the provisions of Public Law 16. Forty-two of the total 767 male veterans entered as graduate students, either as candidates for the Master of Science degree or Doctor of Philosophy, or as candidates for both degrees. Thirty-four veterans entered Iowa State College in short term courses,

Table 2. Sample of Veteran Status of Male Students Entering Iowa State College

	Received B.S. Degree		Transferred		Dropped		Total	
	No. Sampled	No. Inc.	No. Sampled	No. Inc.	No. Sampled	No. Inc.	No. Sampled	No. Inc.
P.L. 16		181		51		118		350
P.L. 346	318	214	84	56	120	80	522	350
Nonveteran	453	197	138	60	218	93	809	350

such as rural building, herdsman, dairy plant operation, farm operation, and drafting. A total of 237 entered as transfer students, having started their college education at an institution other than Iowa State College. Sixty-six veterans in training at Iowa State under the Vocational Rehabilitation Act had started their college education at Iowa State College before induction into the armed forces.

A total of 388 veterans under Public Law 16 entered Iowa State College with no previous college or university experience. Of the total 388, there were 34 enrolled during the spring quarter of 1955, and records were incomplete for four students. The remaining 350 students were included in this study as shown in Table 3.

Table 3. Classification of Male Students Without Previous College Experience Entering Iowa State College as Freshmen

	B.S. Degree	Transferred	Dropped	Total
P.L. 16	181	51	118	350
P.L. 346	214	56	80	350
Nonvet.	197	60	93	350

It is noted that of the 350 veterans enrolled at Iowa State College under Public Law 16, 181 or 52% completed their college education to receiving a BS degree, 51 or 14% transferred to another college and 118 or 34% dropped out for personal or scholastic reasons. Two of the 118

included in this latter category were deceased.

It was intended that a part of the investigation was to include an analysis of the veterans disability and achievement at Iowa State College. However, a review of the disabilities revealed a number of individuals who could be identified by the nature of the disability and it was also found that the number of veterans in each disability grouping was too small to give reliable results. Of the 350 veterans included in the investigation, records were available for 281 veterans. The remaining 69 case folders could not be located due to the veteran leaving the state or being classified as rehabilitated. The degree of impairment ranged for 10% to 100% and the most common causes of impairment were amputations, psychoneurosis, and cases whereby the degree of disability was assessed on basis of a combination of impairments. The observations of those

Table 4. Nature and Degree of Impairment and Apparent Success at Iowa State College

Nature of Impairment	Degree of Impairment (Range)	Completed B.S.	Transfer or Drop
Amputation	20-100	9	6
Ankylosis	10- 50	8	4
Gun Shot Wounds	10-100	28	13
Injuries causing limited motion	10- 60	22	16
Psychoneurosis	10-100	33	29

that completed their college education to receiving the Bachelor of science degree in each of the mentioned classifications is shown in Table 4.

The Serviceman's Readjustment Act of 1944[1] or, as it is commonly referred to, the GI Bill of Rights, was passed by the 78th Congress and signed by the President on June 22, 1944. Also known as Public Law 346, the GI Bill provides for federal government aid for the readjustment in civilian life of returning World War II veterans. Public Law 346 states that a veteran with 90 days or more active duty in the armed forces and discharged or released from active duty under conditions other than dishonorable is entitled to education or training for a minimum of one year plus an additional period not to exceed the time in active service up to a maximum of four years.

There are two types of education or training provided under Public Law 346 in which the veteran may enroll. One is called institutional and is offered in universities and colleges, businesses, technical and vocational schools. The second type of education or training is called on-the-job, which is the learning of an occupation through experiences on a job and often included organized related instruction.

Since approximately 12,500 veterans had entered institutional training at Iowa State College, the cases selected for the original

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[1]U.S. Congress, 78th. 2nd Session. Serviceman's Readjustment Act of 1944, June 22, 1944. Public Law 346. Washington, D. C., U.S. Government Printing Office. 1946.

sample was made by going through the registrar's files on veterans and taking every tenth case in alphabetical order. This gave a total of 1156 Public Law 346 veterans cases to be studied. Forty-five of the 1156 were female leaving a total of 1111 male veteran students enrolled under provisions of Public Law 346. Ninety-eight veterans entered Iowa State College as graduate students and 53 entered in short term courses as previously mentioned. One hundred twenty-six veterans returned to Iowa State College under the GI Bill to resume their education which they had started at Iowa State prior to induction into the armed forces. Three hundred twelve veterans entered Iowa State College by transferring from another institution. As shown in Table 2 the remaining 522 veterans entered Iowa State College as freshman under Public Law 346. Three hundred eighteen, or 61% of the total 522 veterans entering Iowa State College with no previous college experience graduated with a Bachelor of Science degree. Two hundred four did not complete their education at Iowa State College, of this total 84, or 16% transferred to another college, university or vocational school, and 120, or 23% dropped out for personal or academic reasons.

A total of 1237 male nonveteran undergraduate students records were compiled from the registrar's office and included in this group, 19 were enrolled in the aforementioned short term courses and 459 were transfers, from other institutions, to Iowa State College. From the total of 809 nonveteran students it was found that 453, or 56% students graduated with a Bachelor of Science degree, 138, or 17% transferred to another college or university and 218, or 27% dropped out of school for personal or

academic reasons. Again the relationship in percent of the number in each group to the total sample of 809 was used, and random numbers were employed to select the actual cases to be investigated.

The median age for the veteran entering training at Iowa State College under Public Law 16 was 22 years 6 months, ranging in age from 18 years 2 months to 40 years 7 months. The median age for veterans entering training under Public Law 346 was 21 years 8 months, ranging from 17 years 8 months to 48 years 1 month. The median age for nonveteran students was 18 years 6 months, ranging from 17 years 1 month to 29 years 3 months.

V. ACHIEVEMENT-GRADE POINT AVERAGE

Two criteria of achievement have been used in the evaluation of achievement in this study, i.e., grade point average and survival-attrition tendency.

The grade point average is the cumulative average of all course marks at Iowa State College. The letter marks on A, B, C, D and F have been assigned numerical values of 4, 3, 2, 1 and 0, respectively. In computing the grade point average, each course mark has been weighted by the number of hours of credit which each course carries. Thus, for any given student, grade point averages may vary from 4.00 to 0.00.

The three groups, considered here as samples, are the 350 disabled veterans, the 350 other veterans and the 350 nonveterans. A disabled veteran is defined as a student who is attending college under the provisions of Public Law 16 (usually referred to as PL-16); other veteran as one who is attending under the provisions of Public Law 346 (usually referred to as PL-346 or GI) and the nonveteran as one who is attending without such benefits, presumably, without prior military service.

A. Evaluation Without Control

The mean grade point averages for the three groups of students were as follows:

PL-16 = 2.096

PL-346 = 2.230

Nonvet = 2.202

Tests of significance between these means were made by the usual t-test and are shown in Table 5. In this table as well as elsewhere in the report of this study a single asterisk (*) represents significance at the 5% level and a double asterisk (**) represents significance at the 1% level.

Table 5. Significance of Difference between Group Grade Point Averages without Control

Comparison	Mean Average PL-16	PL-346	Nonvet	t
PL-16 and PL-346	2.096	2.230		2.45*
PL-16 and Nonvet	2.096		2.202	1.81
PL-346 and Nonvet		2.230	2.202	0.52

The difference between the means between the disabled veterans and other veterans was the only significant difference found and this difference, with 350 students in each group, was less than that required for the 1% level. On an average, in the two groups considered, the disabled veterans achieved approximately one-seventh of a letter mark lower grade point average than did other veteran students. The difference between the disabled students and the nonveteran students was not significant although the t-value of 1.81 approached significance in favor of the nonveteran students. The PL-346 students excelled the nonveteran students, on an average, by approximately one-thirty sixth of a letter mark, far short of that required for significance.

The foregoing inferences have been made without consideration of possible differences among the three groups in student aptitude. Four measures of student aptitude were readily available from administrative routine by which the scholastic aptitude might be evaluated, i.e., (1) high school grade average, (2) the quantitative score on the American Council on Education Psychological Examination (referred to as ACE-Q), (3) the linguistic score on the American Council on Education Psychological Examination (referred to as ACE-L) and (4) the English Placement score.

Table 6. Means of Criterion and Student Aptitude Variables

Variables	PL-16	PL-346	Nonvet
Grade Point Ave.	2.096	2.230	2.202
High School Ave.	2.448	2.590	2.822
ACE-Q	54.14	56.11	58.84
ACE-L	53.70	51.21	53.62
English Placement	48.66	49.45	52.22

Differences in means for each of the three groups with the foregoing variables are shown in Table 6. An inspection of this table suggests that the nonveteran student on an average is somewhat superior to the veteran student in student aptitude.

Tests of significance (t-tests) were made between the differences in

means among the combinations of the student aptitude variables and are shown in Table 7. An inspection of Table 7 indicates that there were significant differences between groups on high school averages, the nonveterans excelling either group of veterans and the disabled veterans receiving lower high school averages than other veterans. With the other aptitude variables, no significant differences were found among groups except in the ACE-Q with the nonveterans excelling the disabled veterans at the 5% level. Although nonsignificance prevails throughout this table, it is apparent that differences among the groups studied suggest the superiority in student aptitude of the nonveterans over the other veterans and, in turn, other veterans over the disabled veterans.

Table 7. Tests of Significance between Means of Aptitude Variables

Variable	PL-16	PL-346	Nonvet	t
High School Average	2.448	2.590		2.94**
	2.448		2.822	7.93**
		2.590	2.822	4.94**
ACE-Q	54.14	56.11		0.96
	54.14		58.84	2.18*
		56.11	58.84	1.30
ACE-L	53.70	51.21		1.17
	53.70		53.62	.03
		51.21	53.62	1.12
English Placement	48.66	49.45		0.39
	48.66		52.22	1.71
		49.45	52.22	1.31

If any attempt is made to control on these student aptitude variables, such control must be predicated upon relationship between the criterion (grade point average) and the student aptitude as indicated by the available evidence of high school average, ACE-Q, ACE-L and English Placement. The relationships are shown in Table 8.

Table 8. Relationship between Grade Point Averages and Available Variables of Student Aptitude

Variable	Group	r
High School Average	PL-16	.467
	PL-346	.442
	Nonvet	.589
ACE-Q	PL-16	.282
	PL-346	.359
	Nonvet	.287
ACE-L	PL-16	.238
	PL-346	.359
	Nonvet	.380
English Placement	PL-16	.424
	PL-346	.463
	Nonvet	.404

If each of these variables of student aptitude was considered alone, the relative usefulness in predicting grade point averages was high school average, English Placement score, ACE-Q and ACE-L. These coefficients of correlation, on the other hand, yield little or no evidence of the relative usefulness of these four variables when used in a battery for predicting grade point averages. The relative usefulness depends, also,

Table 9. Intercorrelations between Control Variables among Three Groups of Students

Combination	Coefficient of Correlation Among			
	PL-16	PL-346	Nonvet	All
High School Average and ACE-Q	.3068	.3001	.3739	.3321
High School Average and ACE-L	.3768	.3703	.4495	.3878
High School Average and English Placement	.3821	.4114	.4448	.4132
ACE-Q and ACE-L	.5034	.4521	.5695	.5078
ACE-Q and English Placement	.4705	.4729	.4460	.4638
ACE-L and English Placement	.6710	.7474	.6764	.6963

upon the intercorrelations among these control variables. These intercorrelations are shown in Table 9. For each of the intercorrelations, a test of significance was made among the three groups of students by using the formula

$$\text{Chi square} = \Sigma[z^2(N-3)] - \frac{[\Sigma z(N-3)]^2}{\Sigma(N-3)}$$

where

$$z = 1/2 \log_e\left[\frac{1+r}{1-r}\right]$$

None of the six intercorrelations reached the 5% level of significance although 350 students were available in each of the three groups. Thus, the interrelationship of the four control variables can not be demonstrated

to be other than uniform among disabled veterans, other veterans and nonveterans. The foregoing interpretation, on the other hand, yields no evidence with respect to significance of mean differences among the three groups. Such analysis has been shown in Table 7.

B. Evaluation With Student Ability Control

The four available variables for control from administrative routine at the end of freshman week activities are (1) the high school grade point average, (2) the ACE quantitative score, (3) the ACE linguistic score, and (4) the English Placement test score. Justification for this control is based upon allowing for the bias that occurs for differences in student ability among the three groups of disabled veteran, other veteran and nonveteran students in student aptitude as well as upon providing more sensitive tests of significance among any two combinations of these three groups. Analysis of covariance was used in making the desired tests of significance.

1. The PL-16 and Nonveteran Student

One of the comparisons tested was between the disabled veteran and the nonveteran student. Without control, the latter excelled the former in mean grade point average (2.202 to 2.096), this difference was not significant. On the other hand, some, or all, of this difference might have resulted from differences in student ability as indicated in Table 6 in which the nonveteran appears to have excelled in student ability.

The test of significance resulting from an analysis of covariance was made by computing two regression equations - one for predicting the grade point average when PL-16 and nonveteran students were considered to be a single group and another, when the average regression was determined for the two groups. The former is referred to as the total regression and the latter as the within regression. In each case deviation sums of squares and cross-products have been used for convenience. For the former regression deviation sums of squares and of cross-products have been found from the general mean and for the latter regression from the means of the PL-16 students and nonveteran students.

The method of least squares was employed to find the most appropriate values of a_1, a_2, a_3 and a_4 in the equation

$$y = a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4$$

where

y = deviation grade point average

x_1 = deviation high school average

x_2 = deviation ACE-Q score

x_3 = deviation ACE-L score

x_4 = deviation English Placement score

In this method values of a_1, a_2, a_3 and a_4, are desired such that the sum of the squares of the errors in predicting grade point averages is a minimum, i.e.,

$$\Sigma[y - a_1x_1 - a_2x_2 - a_3x_3 - a_4x_4]^2 = \text{a minimum}$$

By the calculus, the values may be obtained by differentiating with respect to a_1, a_2, a_3 and a_4, respectively and in each case setting the first derivative equal to zero. Upon simplification, the four normal equations are

$$\Sigma x_1 y = a_1 \Sigma x_1^2 + a_2 \Sigma x_1 x_2 + a_3 \Sigma x_1 x_3 + a_4 \Sigma x_1 x_4$$

$$\Sigma x_2 y = a_1 \Sigma x_1 x_2 + a_2 \Sigma x_2^2 + a_3 \Sigma x_2 x_3 + a_4 \Sigma x_2 x_4$$

$$\Sigma x_3 y = a_1 \Sigma x_1 x_3 + a_2 \Sigma x_2 x_3 + a_3 \Sigma x_3^2 + a_4 \Sigma x_3 x_4$$

$$\Sigma x_4 y = a_1 \Sigma x_1 x_4 + a_2 \Sigma x_2 x_4 + a_3 \Sigma x_3 x_4 + a_4 \Sigma x_4^2$$

Substituting the needed sums of squares and cross-products which, for total deviation form, may be found from the appendix tables, the equations become

$$182.9789 = 294.30426a_1 + 4493.4365a_2 + 5138.1478a_3 + 5183.9947a_4$$

$$4447.8965 = 4493.4365a_1 + 568136.95a_2 + 305301.96a_3 + 252936.66a_4$$

$$5717.1329 = 5138.1478a_1 + 305301.96a_2 + 575091.08a_3 + 372233.4a_4$$

$$6196.2658 = 5183.9947a_1 + 252936.66a_2 + 372233.4a_3 + 533792.71a_4$$

Upon solution of these simultaneous equations, the regression equation for total was found to be

$$y = 0.4671x_1 + 0.000639x_2 + 0.0018146x_3 + 0.0053131x_4$$

The analysis of regression from this equation is shown in Table 10. An F-test of the significance of the usefulness from zero of the control items in predicting grade point average yielding a highly significant advantage in control was found to be significant. This finding, of

Table 10. Analysis of Total Regression for Predicting Grade Point Average from Control Variables in Groups of PL-16 and Nonveteran Students

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Regression	4	135.1954	33.80	83.11
Residuals	695	282.4480	0.4067	
Total	699	417.6434		

$$R = \sqrt{\frac{135.1954}{417.6434}} = .5690$$

course, was anticipated. It is probable that no educational psychologist is interested in this test of significance, since it is well known that control variables of this type are related to achievement regardless of the criterion of achievement which may be postulated. The coefficient of multiple correlation of .5690 was surprisingly low as judged by the correlations shown in Table 8. This slight increase in forecasting efficiency results from the high interrelationship among control variables as shown in Table 9.

For the purpose of comparing the PL-16 students with the nonveteran students, the analysis of covariance requires a regression equation based upon the substitution of <u>within values</u> in the normal equations and were

$$176.0304 = 269.81474a_1 + 4185.958a_2 + 5143.0109a_3 + 4950.9393a_4$$

$$4360.6612 = 4185.938a_1 + 56275.9a_2 + 305363.02a_3 + 250010.34a_4$$

$$5718.5126 = 5143.0109a_1 + 305363.02a_2 + 575090.11a_3 + 372279.68a_4$$

$$6130.1495 = 4950.9393a_1 + 250010.34a_2 + 372279.68a_3 + 531574.83a_4$$

Upon solution for values of a_1, a_2, a_3 and a_4, the within equation became

$$y = 0.514425x_1 + 0.000735x_2 + 0.001487x_3 + 0.005353x_4$$

The analysis of regression is shown in Table 11.

Table 11. Analysis of Within Regression for Predicting Grade Point Average from Control Variables in Groups of PL-16 and Nonveteran Students

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Regression	4	135.0827	33.77	83.65
Residuals	694	280.5897	0.4037	
Total	698	415.6724		

$$R = \sqrt{\frac{135.0827}{415.6724}} = .5701$$

From the information shown in Tables 10 and 11, an analysis of covariance was made as is shown in Table 12. There was a significant difference between the achievement of disabled veterans and nonveterans

Table 12. Analysis of Covariance of Grade Point Averages between Disabled Veteran and Nonveteran Students

Source of Variation	Residuals		
	Degrees of Freedom	Sum of Squares	Mean Square
Total Residuals	695	282.4480	
Within Residuals	694	280.5897	0.4043
Difference	1	1.8583	1.8583
	F = 4.60*	t = 2.14*	

in grade point average when allowances were made for group differences on the four available variables of student aptitude.

An estimate was needed of the differences in the mean of grade point averages when adjusted for differences in mean aptitude as revealed by each of the four control variables. The within regression was used for this purpose, the difference between a subgroup mean and the general mean being substituted in this equation. Thus for the PL-16 students

$$\text{adjustment of } \bar{Y} = 0.514425\ (2.6352 - 2.4482) + 0.000735\ (56.491 - 54.143) + 0.001487\ (53.660 - 53.697) + 0.0053535\ (50.443 - 48.663)$$

The necessary adjustment then is 0.1074. Since this value is positive,

the adjusted mean for the PL-16 students was found by adding the 0.1074 to the actual grade point average and, since there are equal numbers in the two groups, the adjusted mean for the nonveteran students was found by subtracting 0.1074 from the actual grade point average of the nonveteran group. Thus, the adjusted mean grade point average for the PL-16 students is 2.2033 and for the nonveteran students, 2.0946, the difference favoring the PL-16 student by 0.1087, or approximately one-tenth of a letter mark per course. If actual rather than adjusted grade point average should be used, the difference in mean grade point average is 0.1061 favoring the nonveteran students. The inference, at the 5% level, was demonstrated that the PL-16 student excels the nonveteran student when student aptitude is controlled.

2. The PL-16 and PL-346 Student

A second comparison tested was between the disabled veteran and other veteran students. Without control the disabled veteran student had on an average about one-seventh of a letter mark lower average than the other veteran students as shown in Table 6, the difference being significant at the 5% level.

The evaluation of the difference with student ability control was made by an analysis of covariance in the manner as the foregoing comparison for PL-16 and nonveteran student. The equations for prediction were found to be:

for total $y = 0.3682x_1 + 0.002369x_2 + 0.0000401x_3 + 0.0072535x_4$

for within $y = 0.3606x_1 + 0.002315x_2 + 0.0002304x_3 + 0.0071887x_4$

The analysis of covariance is shown in Table 13.

Table 13. Analysis of Covariance of Grade Point Averages between Disabled Veteran and Other Veteran Students

Source of Variation	Residuals		
	Degrees of Freedom	Sum of Squares	Mean Square
Total Residuals	695	259.7172	
Within Residuals	694	258.7789	0.3729
Difference	1	0.9383	0.9383
	F = 2.516	t = 1.59	

No significant difference in achievement as revealed by the grade point average was found between disabled veteran and other veteran students. Usually no attempt is made to adjust means for group for differences in student ability when the t-value obtained from covariance analysis is nonsignificant. This adjustment, however, has been made here because of the large number of students in each group. The adjusted means in the groups studied are 2.127 for the disabled veterans and 2.189 for the other veterans, or a difference in the adjusted means of approximately one-sixteenth of a letter mark. Superiority in achievement as measured by grade point average could not be demonstrated for either group of veteran students.

3. The PL-346 and Nonveteran Student

A third comparison tested was between veteran students attending Iowa State College under the provisions of Public Law 346 and nonveteran students. Without control, the PL-346 students excelled the nonveteran students in grade point average 2.230 to 2.202. The difference about one fortieth of a letter mark is nonsignificant. The nonveteran students, however, apparently excelled in student ability as shown in Table 7.

The evaluation of the difference with student ability control was made by an analysis of covariance in the same manner as the foregoing group comparisons have been made. The equations for prediction were found to be:

For total $y = 0.4208x_1 + 0.002034x_2 + 0.000239x_3 + 0.00584x_4$

For within $y = 0.4482x_1 + 0.002086x_2 + 0.0003867x_3 + 0.0054015x_4$

Table 14. Analysis of Covariance of Grade Point Averages between Other Veteran and Nonveteran Students

Source of Variation	Residuals		
	Degrees of Freedom	Sum of Squares	Mean Square
Total Residuals	695	239.9932	
Within Residuals	694	237.1169	0.3417
Difference	1	2.8763	2.8763
	F = 8.42**	t = 2.90**	

The analysis of covariance is shown in Table 14.

The difference between the means of the grade point average was significant with student ability control although nonsignificant without such control. The adjusted means were 2.293 for the PL-346 students and 2.157 for the nonveteran students. The difference favoring the PL-346 student was approximately one-seventh of a letter grade when student ability was controlled.

C. Prediction of Grade Point Average for All Students

For the purpose of predicting grade point average a single regression equation seemed to offer promise. An analysis, previously shown, of differences in the relationships between combinations of the control variables, shown in Table 8 were found to be nonsignificant except for high school average and grade point average, the relationship being more pronounced in the nonveteran group. Although 350 students were involved in each group this discrepancy was significant at the 5% level only although 350 students were involved. With so many students included in the analysis, little evidence was available to refute the assumptions necessary for deriving a within-group regression necessary for predicting grade point averages for all students.

The sums of squares and cross-products needed for the normal equation were obtained by adding these deviation sums within each of the three groups of students. The resulting normal equations were:

$$240.76547 = 412.4890a_1 + 6026.646a_2 + 7446.507a_3 + 7433.321a_4$$

$$6629.363 = 6026.646a_1 + 829393.41a_2 + 427031.00a_3 + 373437.96a_4$$

$$8019.095 = 7446.507a_1 + 427031.00a_2 + 847735.59a_3 + 569955.59a_4$$

$$9008.879 = 7433.321a_1 + 373437.96a_2 + 569955.59a_3 + 788117.31a_4$$

Solution of these equations yielded a prediction equation

$$y = 0.437699x_1 + 0.00073757x_2 + 0.0017605x_3 + 0.005935x_4$$

where

y = grade point average in deviation form

x_1 = high school average in deviation form

x_2 = ACE-Q score in deviation form

x_3 = ACE-L score in deviation form

x_4 = English Placement score in deviation form

The sum of squares for regression was 176.4366 which yielded a coefficient of multiple correlation of 0.5580. In computing this sum of squares for regression, it was noted that the ACE-L score contributed the least of any of the four variables, suggesting solution of the normal equation with all sums of squares and crossproducts eliminated which contain an x_3 in it.

Solution of the remaining three equations yielded a prediction equation

$$y = 0.440954x_1 + 0.0019255x_2 + 0.00635955x_4$$

The sum of squares for regression was 176.2237 and yielded a coefficient

of correlation of 0.5577. The ACE-L score added practically nothing in prediction accuracy when used in a battery with the other three control variables. A test of significance of this loss was made, and a t-value of 0.02 was obtained. The ACE-L, obviously, may be eliminated in the prediction battery.

In computing the sum of squares for regression from the three variable battery, after removal of the ACE-L score, it was noted that the ACE-Q score contributed the least to this sum of squares. A regression equation was then found eliminating both the ACE-Q and the ACE-L scores. Solution of the two remaining normal equations yielded a prediction equation

$$y = 0.45504x_1 + 0.007139x_4$$

The sum of squares for regression was 173.8727 and yielded a coefficient of multiple correlation of 0.5539. A test of significance occurring when the ACE-Q was eliminated from the battery of three variables yielded a t-value of 2.28 which is significant at the 5% level but not at the 1% level.

The coefficients of multiple correlation from the four, three and two variable batteries are 0.5580, 0.5577 and 0.5539, respectively. Although the difference between the last two coefficients is significant, the practical value of including the ACE-Q does not seem justified.

When only one variable is used in prediction, the coefficients of correlation for high school average and for English Placement score are

0.4437 and 0.3798. The loss incurred by predicting grade point average from high school average alone or from English Placement scores alone rather than from a battery of both these prediction variables is, in each case highly significant and of practical importance.

The information available from this study has been reasonably clear-cut that the regression equation in deviation form should be

$$y = 0.45504x_1 + 0.007138x_4$$

where

y = grade point average

x_1 = high school average

x_4 = English Placement score (percentile)

An inspection of the analyses shown in Tables 8, 9 and 10, suggests that if the regression equation in deviation form be put into raw score form, which counselors desire, that different constants be added depending upon whether a student is a PL-16, a PL-346 or a nonveteran student. For the nonveteran student, with the information available for 350 nonveteran students, the prediction equation most satisfactory is

$$Y = 0.45504X_1 + 0.007139X_4 + 0.62588$$

Predictions of grade point averages for nonveterans have been made in Table 15, for the convenience of personnel workers. From available information 0.16, approximately one-sixth of a letter mark, should be added for the student enrolling under the G.I. Bill of Rights and 0.09, or approximately one-eleventh of a letter mark, should be added for a disabled veteran attending Iowa State College under the provisions of PL-16.

Table 15. Grade Point Average Prediction from High School Average and English Placement Score

H.S.Ave.	10	20	30	40	50	60	70	80	90	100
4.00	2.44	2.51	2.58	2.65	2.72	2.79	2.86	2.94	3.01	3.08
3.8	2.35	2.42	2.49	2.56	2.63	2.70	2.77	2.85	2.92	2.99
3.6	2.25	2.33	2.40	2.47	2.54	2.61	2.68	2.75	2.83	2.90
3.4	2.16	2.23	2.31	2.38	2.45	2.52	2.59	2.66	2.73	2.81
3.2	2.07	2.14	2.22	2.29	2.36	2.43	2.50	2.57	2.64	2.72
3.0	1.98	2.05	2.12	2.20	2.27	2.34	2.41	2.48	2.55	2.62
2.8	1.89	1.96	2.03	2.10	2.18	2.25	2.32	2.39	2.46	2.53
2.6	1.80	1.87	1.94	2.01	2.09	2.16	2.23	2.30	2.37	2.44
2.4	1.71	1.78	1.85	1.92	1.99	2.07	2.14	2.21	2.28	2.35
2.2	1.62	1.69	1.76	1.83	1.90	1.97	2.05	2.12	2.19	2.26
2.0	1.53	1.60	1.67	1.74	1.81	1.88	1.95	2.03	2.10	2.17
1.8	1.44	1.51	1.58	1.65	1.72	1.79	1.86	1.94	2.01	2.08
1.6	1.34	1.42	1.49	1.56	1.63	1.70	1.77	1.84	1.92	1.99
1.4	1.25	1.32	1.40	1.47	1.54	1.61	1.68	1.75	1.82	1.90
1.2	1.16	1.23	1.31	1.38	1.45	1.52	1.59	1.66	1.73	1.80

Note: Add 0.16 to prediction for a PL-346 student and add 0.09 for a PL-16 student.

It is impossible, as indicated by a coefficient of multiple correlation of 0.5539, to predict accurately the grade point average for any given entering freshman, the standard error of estimate being 0.374. The personnel worker can be reasonably sure, if he makes enough predictions that only in one-third of his predictions will he be wrong by more than 0.374, or approximately three-eighths of a letter mark. Inaccurate as a prediction may be for any given individual, it is much better than it would be if student aptitude is ignored.

VI. ACHIEVEMENT-SURVIVAL AND ATTRITION

Entering freshmen at Iowa State College may be classified a few years later into three groups, i.e., freshmen who later graduated into Iowa State College; freshmen who later transfer to some other college or university; and freshmen who terminate their college experience prior to graduation at Iowa State College without transferring to another institution. For convenience these groups are designated as graduated, transfer and drop-out student groups, respectively, and in table headings may be abbreviated to grad, trans and drop.

From the standpoint of the counsellor, and most certainly from the standpoint of the entering freshman, the time when prediction into this trichotomy is desirable is at college entrance or, if possible prior to that time. It is, of course, impossible to predict accurately for any individual freshman whether he will graduate, transfer or drop out. It is possible, with certain assumptions, to indicate the probability that he will be in any one of the three categories of survival-attrition, depending upon his student aptitude as indicated from his scores on the control variables. It is assumed here that the survival-attrition tendency is a characteristic which is normally distributed. With some freshmen this tendency is so great that the probability of graduation is large whereas in other freshman this tendency is so low that the probability of not completing a college curriculum is large. It is also assumed that this survival-attrition tendency is linearly related to any other variable to be here investigated. These two assumptions can not

be demonstrated to be satisfactory. On the other hand, neither logical considerations nor group differences in control variables, such as high school average, ACE-Q, ACE-L or English placement scores, provide evidence which would refute the soundness of these two basic considerations.

Under these two assumptions, all drop-out students are assigned the average survival-attrition value as determined from the normal curve by the formula

$$\frac{z_l - z_h}{p}$$

Where

z_l = height of ordinate at lower end of the drop-outs

z_h = height of ordinate at upper end of the drop-outs

p = proportion of all students who drop-out

For the drop-out the $z_l = 0$, thus the mean value for a drop-out is $\frac{-z_h}{p}$. In similar manner, average values may be obtained for the middle category of transfer students and for the upper category of graduation from Iowa State College.

The two criteria of achievement, grade point average and survival-attrition tendency should to some extent be related if each of these criteria is a measure of achievement. For obtaining this relationship, the coefficient of triserial correlation was obtained between grade point average and survival-attrition tendency by the formula identical to that

proposed by Jaspen[1].

$$r_{ser.} = \frac{\Sigma[\Sigma y_1 (z_1 - z_h)]}{\sigma y \Sigma[\frac{N(z_1 - z_h)^2}{p}]}$$

The numerator for this formula when applied to the PL-16 students was

for grad. : .77063 (468.383)

for trans. : -.22903 (110.037)

for drop. : -1.08335 (155.130)

Total = 167.68813

and

$$\sigma y = \frac{\Sigma y^2}{N}$$

$$= \frac{214.653903}{350} = .78313$$

and

$$\Sigma[\frac{N(z_1 - z_h)^2}{p}] =$$

for grad. : $(.77063)^2$ (181) = 107.49058

for trans. : $(-.22903)^2$ (51) = 2.67519

for drop. : $(-1.08335)^2$ (118) = 127.83530

Total = 238.00107

and

$$r_{serial} = \frac{167.68813}{(.78313)(238.00107)} = .8997$$

---

[1]Jaspen, Nathan. Serial Correlation. Psychometrika. 11. 23-30. 1946.

This high coefficient of correlation indicates the similarity of grade point average and survival-attrition tendency as here defined. In a similar fashion, the triserial correlations have been computed among the PL-346 and nonveteran students. These coefficients are shown in Table 16.

Table 16. Triserial Coefficient of Correlation between Survival-Attrition Tendency and Grade Point Average

Group	Triserial Coefficient of Correlation
PL-16	.8997
PL-346	.8512
Nonvet	.8912

The two criteria of achievement, grade point average and survival-attrition tendency are highly related. These correlations do not guarantee a normal distribution of survival-attrition tendency. On the other hand, the high correlation is entirely compatible with an assumption of a normal distribution of survival-attrition tendency with a linear relationship to grade point average.

A. Evaluation Without Control

With the three groups of students for whom information was available for analysis, three comparisons are possible, i.e., PL-16 and nonveteran students; PL-16 and PL-346 students; and PL-346 and nonveteran students.

students. The evaluation of discrepancies from expected number of students if the null hypothesis was postulated may be found for each of the three comparison groups by computing chi square.

1. PL-16 and Nonveteran Students

The number of students who graduated, who transferred and who dropped out of Iowa State College without transferring are shown in Table 17. Although an inspection of this table indicates superiority in survival-attrition tendency for the nonveteran, the difference was not significant as shown by a chi-square value of 4.37 with two degrees of freedom.

Table 17. Survival-Attrition without Control for PL-16 and Nonveteran Students

Group	Grad	Trans	Drop	Chi Square
PL-16	181	51	118	4.37
Nonveteran	197	60	93	

2. PL-16 and PL-346 Students

The numbers of students who graduated, who transferred and who dropped out are shown in Table 18 for the disabled veterans and GI Bill of Rights Veterans.

An inspection of this table indicates superiority in survival-attrition tendency for the PL-346 over the PL-16 students. The difference is highly significant as indicated by a chi square of 10.28 and two

Table 18. Survival-Attrition without Control for PL-16 and PL-346 Veteran Students

Group	Grad	Trans	Drop	Chi Square
PL-16	181	51	118	10.28**
PL-346	214	56	80	

degrees of freedom. This inference has been drawn without regard to the relative student aptitude in the PL-16 and PL-346 student groups.

3. PL-346 and Nonveteran Students

The number of students who graduated, who transferred and who dropped out are shown in Table 19 for the GI and nonveteran students.

An inspection of this table suggests the superiority of the PL-346 over the nonveteran student but such superiority could not be demonstrated as indicated by a chi-square value of 1.82. It should be noted, again, that the foregoing inference has been based upon similar student aptitude in these two groups of students.

Table 19. Survival-Attrition without Control for PL-346 and Nonveteran Students

Group	Grad	Trans	Drop	Chi Square
PL-346	214	56	80	1.82
Nonveteran	197	60	93	

The foregoing tests between the three combinations of student group should not be considered with too much confidence since differences in student aptitude have been ignored.

B. Evaluation With Control

The evaluation of survival-attrition tendency without control in previous analyses, suggests an evaluation when certain variables presumably related to survival-attrition have been held constant. The control variables, which were readily available, in this study, were high school average, ACE-Q, ACE-L and English placement score.

The usefulness when employed singly, of each of these four controls in predicting survival-attrition tendency was found by computing triserial coefficients of correlation. These correlations are shown in Table 20. In this table are shown similar correlations with grade point averages previously reported in Table 8. In general, the relationships between the control variables and the survival-attrition tendency are similar to those between the same control variables and the grade point averages. If each control variable is considered without regard to variations in the other three variables, the usefulness of these variables in decreasing order of importance, regardless of the criterion, is high school average, English placement score and approximately equal contributions from the ACE-Q and the ACE-L scores.

Another inspection of Table 20 seemed to indicate that relationships of the control variables with grade point averages are slightly higher

for grade point averages than for graduation-attrition tendency. This discrepancy may have resulted from an inherent difference between the criteria of achievement or because of the lack of confirmation of the assumption that the graduation-attrition tendency is normally distributed. Similarities rather than discrpancies among the relationships of each of the control variables with each of the two criteria prevail, an inference not unexpected when a coefficient of correlation between grade point average and graduation-attrition tendency (.8997) is so high.

Table 20. Relationship between Survival-Attrition Tendency and Available Variables of Student Aptitude

Variable	Group	Triserial r Survival-Attrition Tendency	Coefficient of Correlation with Grade Point
High School Average	PL-16	.429	.467
	PL-346	.456	.442
	Nonvet	.469	.589
ACE-Q	PL-16	.222	.282
	PL-346	.397	.359
	Nonvet	.243	.287
ACE-L	PL-16	.306	.238
	PL-346	.313	.359
	Nonvet	.379	.380
English Placement	PL-16	.306	.424
	PL-346	.445	.463
	Nonvet	.456	.404

1. The PL-16 and Nonveteran Student

Differences in tendency to graduate; to transfer to another college or university; and to drop out of Iowa State College without transfer intentions between the PL-16 and nonveteran students have been found to be nonsignificant as shown in Table 17 whenever differences in student aptitudes were not considered. An inspection of this table shown that in the groups of 350 students, the PL-16 students when contrasted with the nonveteran students tend to graduate less frequently and to discontinue college education more frequently. Although this difference in tendency could not be demonstrated as a conclusion if student ability was ignored, it was deemed necessary to evaluate this same difference when student ability was considered.

The normal equations based upon combining the 350 PL-16 students and the 350 nonveteran students when the deviation values were found from the general mean were:

$$145.4940 = 294.30426a_1 + 4493.4365a_2 + 5138.1478a_3 + 5183.9947a_4$$

$$3324.6066 = 4493.4356a_1 + 568136.95a_2 + 305301.96a_3 + 252936.66a_4$$

$$4736.6154 = 5138.1478a_1 + 305301.96a_2 + 575091.08a_3 + 372233.40a_4$$

$$4874.4317 = 5183.9947a_1 + 252936.66a_2 + 37223.40a_3 + 533792.71a_4$$

Solution of the equations for values of a_1, a_2, a_3 and a_4, yielded a discriminant equation for total deviation of

$$y = 0.3888x_1 - 0.00206x_2 + 0.002446x_3 + 0.00374x_4$$

which produced a Δ, corresponding to sum of squares for regression, of 85,7365. An analysis of total regression is shown in Table 21.

Table 21. Analysis of Discrimination of Survival-Attrition from Control Variables among PL-16 and Nonveteran Students Based on Total Group of 700 Students

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Δ	4	85.7365	21.4341	36.26
Residuals	695	410.8431	0.5911	
Total	699	496.5796		

A similar analysis was made when the entries for the normal equations were obtained from deviation values obtained within the two groups of students. The within discriminant equation was found to be

$$y = 0.3946x_1 - 0.000199x_2 + 0.002218x_3 + 0.003863x_4$$

which yielded a Δ of 81.9962. The analysis is shown in Table 22.

Substitution in the within discriminant equation indicated that the PL-16 student excelled the nonveteran student of equal student aptitudes. An analysis of covariance was made, as shown in Table 23, to test the significance of this difference.

Table 22. Analysis of Discrimination of Survival-Attrition from Control Variables among PL-16 and Nonveteran Students Based on Two Groups of 350 Students

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Δ	4	81.9962	20.4990	36.04
Residuals	694	393.3770	0.5668	
Total	698	475.3732		

Table 23. Analysis of Covariance of Survival-Attrition Tendency between PL-16 and Nonveteran Students

	Residuals			
Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Total Deviation	695	410.8431		
Within Deviation	694	393.3770	0.5668	5.55
Difference	1	17.4661	17.4661	

The PL-16 freshman is superior to the nonveteran freshman of equal student aptitude as indicated by high school average and scores on the ACE-Q, and the ACE-L and the English placement tests.

2. The PL-16 and PL-346 Student

The PL-346 student excelled the PL-16 student in survival-attrition tendency when student aptitude was not considered. Because of comparison of these two groups was desired with some control of student aptitude, two discriminant equations were developed, i.e., one based on total deviation values and another based on within deviation values.

The discriminant equation was found to be for total

$$y = 0.3776x_1 + 0.00325x_2 - 0.000143x_3 + 0.004370x_4$$

which yielded a Δ of 87.3291 from a total sum of squares of 487.1894. An analysis of covariance was made and is shown in Table 24. The difference

Table 24. Analysis of Covariance of Survival-Attrition Tendency between PL-16 and PL-346 Students

Source of Variation	Residuals			
	Degrees of Freedom	Sum of Squares	Mean Square	t
Total Deviation	695	402.2555		
Within Deviation	694	399.8603	0.5762	2.04*
Difference	1	2.3952	2.3952	

in survival-attrition tendency favoring the PL-346 freshman is significant at the 5% level as indicated by a t-value of 2.04.

3. The PL-346 and Nonveteran Student

The PL-346 excelled the nonveteran students in survival-attrition tendency when no attempt was made to control on student aptitude. The difference, however, failed to meet the requirements for significance. For controlling student aptitude, two discriminant equations were developed, one by using deviation values from the general mean and another by using deviation values from the mean of the group in which a student was classified.

The discriminant equation for total was found to be

$$y = 0.3433x_1 + 0.002914x_2 - 0.000314x_3 + 0.005636x_4$$

which yielded a Δ of 89.1422 from a total sum of squares of 486.1459.

Table 25. Analysis of Covariance of Survival-Attrition Tendency between PL-346 and Nonveteran Students

Source of Variation	Residuals			t
	Degrees of Freedom	Sum of Squares	Mean Square	
Total Deviation	695	397.0037		
Within Deviation	694	373.2189	0.5378	6.65**
Difference	1	23.7848	23.7848	

The within discriminant equation was found to be

$$y = 0.3672x_1 + 0.002919x_2 - 0.000504x_3 + 0.005639x_4$$

which yielded a Δ of 92.0412 from a total within sum of squares of 465.2601. An analysis of covariance was made and is shown in Table 25. The difference in survival-attrition tendency favoring the PL-346 freshmen over the nonveteran freshmen with equal student aptitude is significant far beyond the 1% level.

C. Prediction of Survival-Attrition Tendency for All Students

For the purpose of predicting survival-attrition tendency a single discriminant equation seemed to offer promise. An analysis of differences in triserial correlations and survival-attrition tendency among the three groups of students, shown in Table 20, was tested for significance by the formula

$$\text{chi square} = \Sigma[Z^2(N-3)] - \frac{[\Sigma Z(N-3)]^2}{\Sigma(N-3)}$$

after all triserial coefficients were reduced to point triserial correlations.

The chi-square values obtained were 0.0109, 3.2161, 0.2365 and 2.5692 for the differences in relationships of survival-attrition tendency with high school average, ACE-Q score, ACE-L score and English placement score, respectively. None of these chi-square values with two degrees of freedom reached the level required for significance.

The lack of significance in the foregoing tests suggested insufficient evidence for refuting the assumptions necessary for deriving

a within-group discriminant equation for predicting survival-attrition tendency from the control factors for all students although a different constant will appear in the equation depending upon the group, in which any given student may be found, Nonveteran, PL-16 or PL-346.

The sums of squares and cross products needed for the normal equations were obtained by adding these sums within each of the three groups of students. The resulting normal equations were

$$205.57609 = 412.4890a_1 + 6026.646a_2 + 7446.507a_3 + 7433.321a_4$$
$$5917.3586 = 6026.646a_1 + 829392.41a_2 + 427031.00a_3 + 373437.96a_4$$
$$6793.1181 = 7446.507a_1 + 427031.00a_2 + 847735.59a_3 + 569955.59a_4$$
$$7538.30723 = 7433.321a_1 + 373437.96a_2 + 569955.59a_3 + 788117.31a_4$$

Solution of these equations yielded an equation for prediction survival-attrition tendency of

$$y = 0.37455x_1 + 0.002020x_2 + 0.0005714x_3 + 0.004662x_4$$

where

y = sigma scores of attrition-survival tendency

x_1 = high school average in deviation form

x_2 = ACE-Q score in deviation form

x_3 = ACE-L score in deviation form

x_4 = English placement score in deviation form

The foregoing equation yielded a Δ of 127.9768 and a multiple triserial correlation of 0.5135. In computing the foregoing Δ, it was noted that the sum of squares for the ACE-L contributed little, suggesting the possibility of eliminating it from the prediction equation.

A discriminant equation without the ACE-L was found to be

$$y = .37707x_1 + 0.002147x_2 + 0.004991x_4$$

which produced a Δ of 127.8490, a nonsignificant loss from the four variable prediction. The ACE-L was therefore eliminated from the prediction battery.

In computing the Δ for the three variable prediction, the sum of squares for the ACE-Q score was found to be small. A discriminant equation was then found for a battery of two variables with the ACE-Q scores eliminated. The resulting equation was

$$y = 0.39278x_1 + 0.005803x_4$$

which produced a Δ of 124.9248, a loss significant at the 5% level as indicated by $t = 2.28$.

The triserial correlation with survival-attrition tendency for all four control variables was 0.5135, for three variables after the elimination of ACE-L was 0.5132, and after elimination of both the ACE-Q and the ACE-L was 0.5083. Although the loss by eliminating the ACE-Q was significant, the advantage of its inclusion in the battery was so small that, for practical purposes, it was decided to eliminate this variable also.

The discriminant equation based upon high school average and English placement score was changed from deviation form to raw score form in each of 350 student groups. Thus for predicting graduation the equation is

$$Y = 0.39278x_1 + 0.005803x_4 + C$$

where the constant (C) depends upon whether an individual is a PL-16, a

PL-346 or a Nonveteran student. The constants, for graduation in the survival-attrition tendency, are

the Nonveteran student = -1.2563

the PL-16 student = -1.0242

the PL-346 student = -1.2037

If individuals are nonveteran entering freshman with a 4.00 high school average and in the 100th percentile rank on the English placement test, the equation yields the solution

$$Y = 0.39278(4.00) + 0.005803(100) - 1.2563$$

$$Y = 0.8951$$

This Y-value is in sigma units and may be changed to proportion by consulting a table of the normal curve which, for 0.8951 is 0.81. Thus with 100 entering freshmen with such student ability as indicated by the high school average and English placement score, 81 will graduate from Iowa State College.

With another group of 100 nonveteran freshmen with a 1.50 high school average and in the first percentile rank would yield a sigma unit of -0.6613 as revealed by the substitution:

$$Y = 0.39278(1.50) + 0.005803(1) - 1.2563$$

$$= -0.6613$$

The probability of graduation as indicated in a normal curve table is 0.25. Thus with 100 entering freshmen with such evidences of student aptitude only 25 will later graduate from Iowa State College.

If the discriminant equation should be used to predict those who will

graduate from Iowa State College or will transfer to another college or university, the constants are

the Nonveteran student = -0.7887

the PL-16 student = -0.5636

the PL-346 student = -0.8266

Thus for the nonveteran freshman with a 4.00 high school average and with a percentile rank of 100 on the English placement test, a sigma score of 1.3627 is found corresponding to 0.91 that nonveteran entering freshmen will either graduate from Iowa State College or transfer to another institution. Since the probability of graduation for such a student was 0.81, the probability of transferring is 0.10 and the probability of dropping out of college is 0.09.

Table 26. Chances in 100 of Graduation, of Transferring and Dropping from College for Low and High Aptitude Freshmen

Group	Student Aptitude	Chances in 100		
		Grad	Trans	Drop
Nonveteran	Low	25	17	58
	Average	56	17	26
	High	81	10	9
PL-16	Low	27	14	59
	Average	51	15	34
	High	83	8	9
PL-346	Low	33	18	49
	Average	61	16	23
	High	87	7	6

Table 27. Chances in 100 of Entering Freshmen Graduating, Transferring and Dropping from College Prior to Graduation Depending upon High School Average and English Placement Percentile Rank

H.S.Ave.		English Placement																								
		10			20			30			40			50			60			70			80			90		
		NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16
4.00	G	65	73	66	67	75	69	69	77	71	71	78	73	73	80	75	75	82	76	77	83	78	78	84	80	80	86	81
	T	15	13	13	15	12	12	14	11	11	14	11	11	13	10	10	12	9	10	11	9	9	11	9	9	10	8	9
	D	20	14	21	18	13	19	17	12	18	15	11	16	14	10	15	13	9	14	12	8	13	11	7	11	10	6	10
3.80	G	62	70	64	64	72	66	66	74	68	68	76	70	70	78	72	72	79	74	74	81	76	76	83	78	78	84	79
	T	16	14	13	15	13	12	15	13	12	14	12	12	14	11	11	13	11	11	13	10	12	12	9	9	11	9	9
	D	22	16	23	21	15	22	19	13	20	18	12	18	16	11	17	15	10	15	13	9	14	12	8	13	11	7	12
3.60	G	59	67	61	61	69	63	63	71	65	65	73	67	67	75	69	69	77	71	71	79	73	73	80	75	75	82	77
	T	16	15	13	16	14	13	16	14	13	15	13	13	15	12	12	15	12	12	14	11	11	13	11	9	11	10	10
	D	25	18	26	23	17	24	21	15	22	20	14	20	18	13	19	16	11	17	15	10	16	14	9	16	12	8	13
3.40	G	56	64	58	58	67	60	60	69	62	62	71	64	65	73	67	67	75	69	69	77	71	71	78	73	73	80	75
	T	17	16	13	17	14	13	17	14	13	16	13	13	15	13	13	14	12	12	14	11	11	14	11	11	13	10	10
	D	27	20	29	25	19	27	23	17	25	22	16	23	20	14	20	19	13	19	17	12	18	15	11	16	14	10	15
3.20	G	52	62	54	55	64	56	57	66	59	59	68	61	62	70	64	64	72	66	66	74	68	68	76	70	70	78	72
	T	18	15	15	17	15	15	17	15	14	17	14	14	16	14	13	15	13	12	15	13	12	15	12	12	14	11	11
	D	30	23	31	28	21	29	26	19	27	24	18	25	22	16	23	21	15	22	19	13	20	17	12	18	16	11	17

Table 27. (Continued)

H.S.Ave.		English Placement																								
		10			20			30			40			50			60			70			80			90		
		NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16
3.00	G	49	58	51	52	61	54	54	63	56	56	65	58	59	67	61	61	69	63	63	71	65	65	73	67	67	75	69
	T	18	17	15	17	16	14	17	16	14	22	15	14	16	15	13	16	14	13	16	14	13	16	13	12	15	12	12
	D	33	25	34	31	23	32	29	21	30	22	20	28	25	18	26	23	17	24	21	15	22	19	14	21	18	18	19
2.80	G	46	55	48	48	58	51	51	60	53	53	62	55	55	64	58	58	67	60	60	69	62	62	71	64	65	73	66
	T	21	17	15	19	16	14	18	16	14	18	16	15	18	16	14	17	14	13	17	14	13	16	13	13	15	13	13
	D	33	28	37	33	26	35	31	24	33	29	22	30	27	20	28	25	19	27	23	17	25	22	16	23	20	14	21
2.60	G	43	52	45	45	55	47	48	57	50	50	59	52	52	61	54	55	64	57	57	66	59	59	68	61	62	70	64
	T	19	18	15	19	17	15	18	17	15	18	17	15	18	16	15	17	15	14	17	15	14	17	14	14	16	14	13
	D	38	30	40	36	28	38	34	26	35	32	24	33	30	23	31	28	21	29	26	19	27	24	18	25	22	16	23
2.40	G	41	50	43	42	51	44	45	54	47	46	56	49	51	58	51	52	61	54	54	63	56	56	65	58	58	67	61
	T	19	18	15	19	18	15	18	17	14	19	17	15	16	17	15	17	16	14	17	16	14	17	15	14	17	15	13
	D	40	32	42	39	31	41	37	29	39	35	27	36	33	25	34	31	33	32	29	31	30	27	20	28	25	18	26
2.20	G	37	46	39	39	48	41	41	51	44	44	53	46	46	55	48	48	58	51	51	60	53	53	62	55	56	64	58
	T	18	18	15	19	18	15	19	18	14	18	17	15	18	17	15	19	16	14	18	16	14	18	16	15	17	16	13
	D	45	36	46	42	34	44	40	32	42	38	30	39	36	28	37	33	26	35	31	24	33	29	22	30	27	20	29

Table 27. (Continued)

H.S.Ave.		English Placement																								
		10			20			30			40			50			60			70			80			90		
		NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16	NV	346	16
2.00	G	34	43	36	36	45	38	38	48	40	41	50	43	43	52	45	45	55	47	48	57	50	50	59	52	52	61	54
	T	18	18	15	19	18	15	19	17	15	18	18	14	18	18	15	19	17	15	18	17	14	18	17	15	18	16	15
	D	48	39	49	45	37	47	43	35	45	41	32	43	39	30	40	36	28	38	34	26	36	32	24	33	30	23	31
1.80	G	31	40	33	33	42	35	35	44	37	38	47	40	40	49	42	42	51	44	44	54	47	47	56	49	49	58	51
	T	19	18	15	18	18	15	19	19	15	18	18	15	18	18	15	19	18	15	19	17	14	18	17	15	18	17	15
	D	50	42	52	49	40	50	46	37	48	44	35	45	42	33	43	39	31	41	37	29	39	35	27	36	33	25	34
1.60	G	28	37	30	31	39	32	33	41	35	35	44	37	37	46	40	39	48	41	41	51	43	44	53	46	46	55	48
	T	18	18	15	17	18	14	16	19	14	17	18	14	18	18	14	19	18	15	19	17	15	18	17	15	18	17	15
	D	54	45	55	52	43	54	51	40	51	48	38	49	45	36	46	42	34	44	40	32	42	38	30	39	36	28	37
1.40	G	26	34	28	28	36	30	30	38	32	32	41	34	34	43	36	36	45	38	38	47	40	41	50	43	43	52	45
	T	17	18	13	17	18	14	18	19	14	18	18	14	18	18	15	19	18	15	19	18	15	18	18	15	18	18	15
	D	57	48	59	55	46	56	52	43	54	50	41	52	48	39	49	45	37	47	43	35	45	41	32	42	39	30	40

For the nonveteran freshman with a 1.50 high school average and with a percentile rank of 1 on the English placement a sigma score of -0.1937 is found corresponsing to a probability of 0.42 that will either graduate from Iowa State College or transfer to another institution. Since the probability of graduation for such a student was 0.25, the probability of transferring is 0.17 and the probability of dropping out of school is 0.58.

The chances in 100 of graduation from Iowa State College, of transferring to another college or university and of dropping out of college is shown in Table 26 for an entering freshman of low student aptitude and for a student of high student aptitude together with the chances for freshman without regard to student aptitude.

For this table, the low aptitude freshman was defined as one with a high school average of 1.50 and an English placement percentile of 1; the high aptitude freshman as one with a high school average of 4.00 and an English placement percentile of 100; and the average freshman as the typical freshman without regard to evidences of the student aptitude.

For convenience, the probability of graduating, transferring or dropping out of college for PL-16, PL-346 and Nonveteran freshmen is shown in Table 27 for various high school averages and English placement percentile scores. The number among one hundred freshmen who will graduate, transfer or drop from college can be seen to vary with student aptitude.

VII. SUMMARY

The purpose of this study was to investigate the academic achievement of male veteran and nonveteran students who entered Iowa State College without prior college experience. In order that the groups chosen might have had an opportunity to graduate, transfer to another college or university or drop out school, the period from Winter Quarter 1944 through the Spring Quarter 1953 was selected for the study.

Classification of students, for purposes of this study, was made into three groups, namely, those enrolling under the provisions of Public Law 16, Public Law 346, and those who entered without assistance from the Veterans Administration, assumed to be nonveterans.

There were 769 veterans who enrolled at Iowa State College under the Vocational Rehabilitation Act, Public Law 16. Of this number, 388 male veterans entered as freshman without previous college experience. The median age at the time of entrance for this group was 22 years, 6 months. Thirty-four of the 388 were pursuing their education at the time of the study and were not included in this investigation. Also, the records were incomplete for four veterans, leaving a total of 350 veterans who had graduated, transferred or dropped out of school by the Spring Quarter of 1953. Of this group, 181 or approximately 52% graduated from Iowa State College, 118 or 34% dropped out for personal or academic reasons and 51 or 14% transferred to another college or university.

Of the approximately 12,500 veterans who entered Iowa State College, 1156 veterans under Public Law 346 were selected to be studied. Five hundred twenty-two male veterans entered as freshmen without previous college experience. The median age for this group was 21 years, 8 months. Of this total, 318 graduated, 120 dropped and 84 transferred. The relationship in percent of the number in each group to the total sample of 522 was used and by random numbers the 350 actual cases to be studied were selected.

A total of 1237 male nonveteran undergraduate students' records were compiled. From this total of 1237, 809 students had enrolled at Iowa State College as freshmen without previous college experience. The median age for this group was 18 years, 6 months. Four hundred fifty-three or approximately 56% graduated, 218 or 27% dropped and 138 or 17% transferred. Again the relationship in percent of the number in each group to the total sample of 809 was used and by random numbers the 350 cases selected.

Records for the 1050 students were complete with respect to the prematriculation information assembled from the American Council on Education Psychological Examination Quantitative Test, the American Council on Education Psychological Examination Linguistic Test, English Placement Test and the high school grade point average.

Evaluating the scholastic achievement of the three groups of students was the major purpose of this study. Two criteria were available from college records by which achievement could be evaluated. One

criterion was the grade point average from the course marks which the student had received. A second criterion was the survival-attrition tendency as evidenced by a student's graduating from Iowa State College, transferring to another college or university, or dropping out of college for personal or academic reasons.

The similarity of these two criteria was shown by computing the triserial coefficients of correlation between grade point averages and the survival-attrition tendency as here defined. For each of the three groups, these triserial coefficients of correlation were

For Public Law 16 students, 0.8997

For Public Law 346 students, 0.8512

For Nonveteran students, 0.8912

These high correlations indicate the similarity of the two criteria employed in this study.

With grade point average, the first criterion, the means, without considering existing differences in student aptitude, were

For Public Law 16 students, 2.096;

For Public Law 346 students, 2.230;

For Nonveteran students, 2.202.

The t-test for significance between the PL-16 and PL-346 students indicated the greater achievement for the PL-346 group, significant at the 5% level whereas differences between the PL-16 and nonveteran students as well as differences between the PL-346 and nonveterans failed to meet the usual requirements for significance at the 5% level.

An analysis of covariance was then made to evaluate differences among groups in grade point averages when student aptitude as indicated by high school average and English Placement score were controlled. The means adjusted for group differences in aptitude were

For PL-16 and nonveteran students, 2.203 and 2.095, respectively

For PL-346 and nonveteran students, 2.293 and 2.157, respectively

For PL-16 and PL-346 students, 2.127 and 2.189, respectively

The first two of these comparisons were significant, whereas, with the last comparison the difference was nonsignificant.

For the purpose of predicting grade point average, it was found that the high school grade point average and the English Placement percentile score yielded the most satisfactory prediction. For nonveteran students the equation most satisfactory was:

$$Y = 0.455X_1 + 0.007139X_4 + 0.62588$$

Y = grade point average

X_1 = high school grade point average

X_4 = English Placement percentile score

A grade point average prediction table was developed whereby the grade point average could be predicted when given the high school grade point average and the score from the English Placement Test. The table indicated that with a high school grade point average of 3.4 and a score of 80 on the English Placement Test, the predicted grade point average was 2.66 for nonveteran student. Adjustment could be made by adding 0.16 to any prediction for Public Law 346 student and 0.09 for Public Law

16 student. The coefficient of multiple correlation of 0.5539 indicated limitations to a prediction for any given entering freshman, the standard error of estimate being 0.374.

Survival-attrition, as here defined, was the second criterion of achievement. In the three groups of 350 students the number graduating from Iowa State College, number transferring and the number dropping out of college were, respectively

For PL-16 students, 181, 51 and 118

For PL-346 students, 214, 56 and 80

For Nonveteran students 197, 60 and 93

When these discrepancies were evaluated, without control by the use of student aptitude variables, by chi square, only one of the three possible comparisons, PL-16 and PL-346 student, was significant at the 5% level.

Student aptitude was, then, controlled by using high school averages and English Placement scores through discriminant analysis. With such control, the PL-16 students excelled the nonveteran students, contrary to the comparison without control of student aptitude. The difference was significant at the 1% level. The PL-346 students were significantly superior to either the PL-16 students or the nonveteran student when evaluated in terms of survival-attrition tendency when student aptitude was controlled.

Based upon the English Placement scores and high school averages, the chances in 100 of a student graduating will vary from 26 to 80 for nonveteran students; from 34 to 87 for PL-346 students; and from 28 to

83 for the PL-16 students.) For convenience of counselors, a probability table was prepared for indicating the chances in 100 of a student graduating, transferring or dropping out of college for various high school averages and English Placement percentiles.

VIII. LITERATURE CITED

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IX. APPENDIX

Y = grade point average

X_1 = high school grade average

X_2 = ACE-Q percentile rank

X_3 = ACE-L percentile rank

X_4 = English Placement percentile rank

Basic Information for Nonveteran Students

	Graduates	Transfers	Drop	Total
N	197	60	93	350
ΣY	517.370	128.176	125.148	770.694
ΣY^2	1391.611928	295.566272	210.895300	1898.073500
ΣX_1	593.61	166.66	227.53	987.80
ΣX_1^2	1845.4427	484.4634	584.8077	2914.7138
ΣX_2	12484	3442	4668	20594
ΣX_2^2	936592	244092	303034	1483718
ΣX_3	11915	3213	3641	18768
ΣX_3^2	877275	217990	207215	1302480
ΣX_4	11711	3262	3305	18278
ΣX_4^2	852149	225762	172199	1250110
$\Sigma X_1 Y$	1582.12453	368.60226	318.69160	2269.41839
$\Sigma X_2 Y$	33404.683	7570.430	6495.630	47470.743
$\Sigma X_3 Y$	31997.831	7099.475	5159.297	44256.603
$\Sigma X_4 Y$	31470.700	7101.700	4791.154	43363.554
$\Sigma X_1 X_2$	38657.93	9748.84	11917.81	60324.58
$\Sigma X_1 X_3$	37105.53	9077.26	9549.05	55731.84
$\Sigma X_1 X_4$	36545.02	9193.52	8579.00	54317.54
$\Sigma X_2 X_3$	836799	211847	217257	1265903
$\Sigma X_2 X_4$	804144	210567	187206	1201917
$\Sigma X_3 X_4$	814792	199200	166220	1180212

Basic Information for PL-16 Students

	Graduates	Transfers	Drop	Total
N	181	51	118	350
ΣY	468.383	110.037	155.130	733.550
ΣY^2	1237.173977	251.505281	263.390652	1752.069910
ΣX_1	478.43	128.18	250.26	856.87
ΣX_1^2	1339.8103	336.7500	564.1836	2240.7439
ΣX_2	10532	3043	5375	18950
ΣX_2^2	758822	218457	341037	1318316
ΣX_3	10757	3004	5033	18794
ΣX_3^2	763861	212204	312123	1288188
ΣX_4	9646	2979	4407	17032
ΣX_4^2	618418	205467	240935	1064820
$\Sigma X_1 Y$	1259.14368	283.55989	334.90421	1877.60778
$\Sigma X_2 Y$	27778.541	6766.801	7408.704	41954.046
$\Sigma X_3 Y$	28410.321	6673.000	7094.942	42178.263
$\Sigma X_4 Y$	25572.774	6685.706	6452.597	38711.077
$\Sigma X_1 X_2$	28579.28	7964.60	11833.02	48376.90
$\Sigma X_1 X_3$	29520.78	7673.04	11197.48	48391.30
$\Sigma X_1 X_4$	26494.94	7583.75	9838.19	43916.88
$\Sigma X_2 X_3$	704105	197134	260091	1161330
$\Sigma X_2 X_4$	622210	189359	234163	1045732
$\Sigma X_3 X_4$	649096	195888	241772	1086756

Basic Information for PL-346 Students

	Graduates	Transfers	Drop	Total
N	214	56	80	350
ΣY	549.694	114.942	115.817	780.453
ΣY^2	1441.333890	254.043744	195.871747	1891.249381
ΣX_1	592.36	138.98	175.18	906.52
ΣX_1^2	1720.0256	363.9766	405.8666	2489.8688
ΣX_2	13627	2620	3392	19639
ΣX_2^2	1007477	158774	200842	1367093
ΣX_3	12142	2621	3159	17922
ΣX_3^2	851582	160463	178299	1190344
ΣX_4	12097	2515	2694	17306
ΣX_4^2	825829	150801	135620	1112250
$\Sigma X_1 Y$	1542.67253	292.98254	250.49788	2086.15295
$\Sigma X_2 Y$	35409.296	5639.611	5012.134	46061.041
$\Sigma X_3 Y$	31780.408	5734.845	4748.982	42264.235
$\Sigma X_4 Y$	31765.800	5575.903	4127.083	41468.786
$\Sigma X_1 X_2$	38492.53	6716.83	7497.48	52706.84
$\Sigma X_1 X_3$	34863.84	6748.06	7110.60	48722.50
$\Sigma X_1 X_4$	34764.20	6539.06	6002.65	47305.91
$\Sigma X_2 X_3$	843533	137812	145952	1127297
$\Sigma X_2 X_4$	830193	136230	128069	1094492
$\Sigma X_3 X_4$	796941	147339	139562	1083842